

MANUAL

High pressure pumps

Danfoss, Pratissoli, Hawk



Version: 2023-05

Foreword

This installation manual is intended for technicians putting HD (high pressure) pumps into service. It is not a guide for the end user.

This installation manual only contains regulations regarding the safe installation, correct connection and safe operation of HD pumps. This manual does not contain operating instructions for the entire installation; this should be provided by the installer.

Each chapter has a number and, where necessary, chapters are divided into sections. The table of contents on page 3 gives an overview of the chapters and paragraphs, and references to pages.

Table of Contents

Foreword.....	2
Table of Contents	3
1 Identification	4
1.1 General	4
1.1.1 Description of the machine	4
1.1.2 specifications	4
1.1.3 Diagram of the machine	5
1.2 Use	6
1.3 Media	6
1.4 Control and operation	6
1.5 Users	6
1.6 Operating environment	6
1.7 Guarantee provisions	7
1.8 CE mark	8
1.9 Residual risks	8
2 Description	9
2.1 How it works	9
2.2 General	9
2.3 Transport and Storage.....	10
3 Safety instructions	11
4 Installation	12
4.1 General	12
4.2 Assembly	12
4.3 Electrical	13
5 Commissioning.....	14
5.1 Start up	14
5.2 Taking out of service	14
6 Maintenance.....	15
6.1 General.....	15
6.2 Oil Change.....	16
7 Failures.....	17
8 Declaration of conformity	18
Attachments.....	19
Direct electrical connection to the electric motor	20
Electrical connection of pressure switch on the discharge side (OPTIONAL).....	20

1 Identification

This overview contains general information about the machine, with the objective of providing information about the definition, purpose, overall operation and area of application of the machine.

1.1 General

1.1.1 Description of the machine

Van der Ende Groep HD pumps are available in a number of versions. Van der Ende Groep selects the correct components using a computer program on the basis of key requirements such as pressure and capacity, the operating time and the medium to be pumped. A pump set is composed of a suitable plunger pump assembled with an electric motor (2-pole, 4-pole or 6-pole). The high pressure plunger pumps are supplied by various manufacturers, namely Danfoss, Pratissoli and Hawk. Each of these manufacturers has a wide range with various types of pumps. A HD pump set consists of the following components:

1. Drive: 2-pole, 4-pole or 6-pole electric motor;
2. Lantern piece: part between the flange of the motor and the flange of the pump;
3. Pump: axial displacement pump or triplex plunger pump;
4. Pump bracket: metal bracket which fits the base of the electric motor;
5. Vibration damper;
6. Pulsation damper: mounted on the discharge side of the pump (optional);
7. Gauge: mounted on the discharge side of the pump;
8. Overflow valve: mounted on the discharge side of the pump;
9. Hose tail: mounted on the suction side;
10. Flex coupling: between the output shaft of the motor and the output shaft of the pump.

1.1.2 specifications

The specifications for each brand of pump are shown below. More details of any specific HD pump are available on request. Information about the pump itself can be found in the leaflet.

Brand	Danfoss
Type	PAH for drinking water and industry PAHT for osmosis water
Maximum operating pressure	160 bar
Capacity	1.9 - 338 l/min
Maximum power	75 kW

Table 1 Danfoss HD Pump Specifications

Brand	Pratissoli
Type	HF, KE, KF, SN and SS
Maximum operating pressure	300 bar
Capacity	23 to 170 l/min
Maximum power	40 kW

Table 2 Pratissoli HD Pump Specifications

Brand	Hawk
Type	NST, NMT, XLTI, XXT, MXT and HFR
Maximum operating pressure	500 bar
Capacity	4 to 120 l/min
Maximum power	57 kW

Table 3 Hawk HD Pump Specifications

1.1.3 Diagram of the machine

Diagram showing the main components, numbered and named.

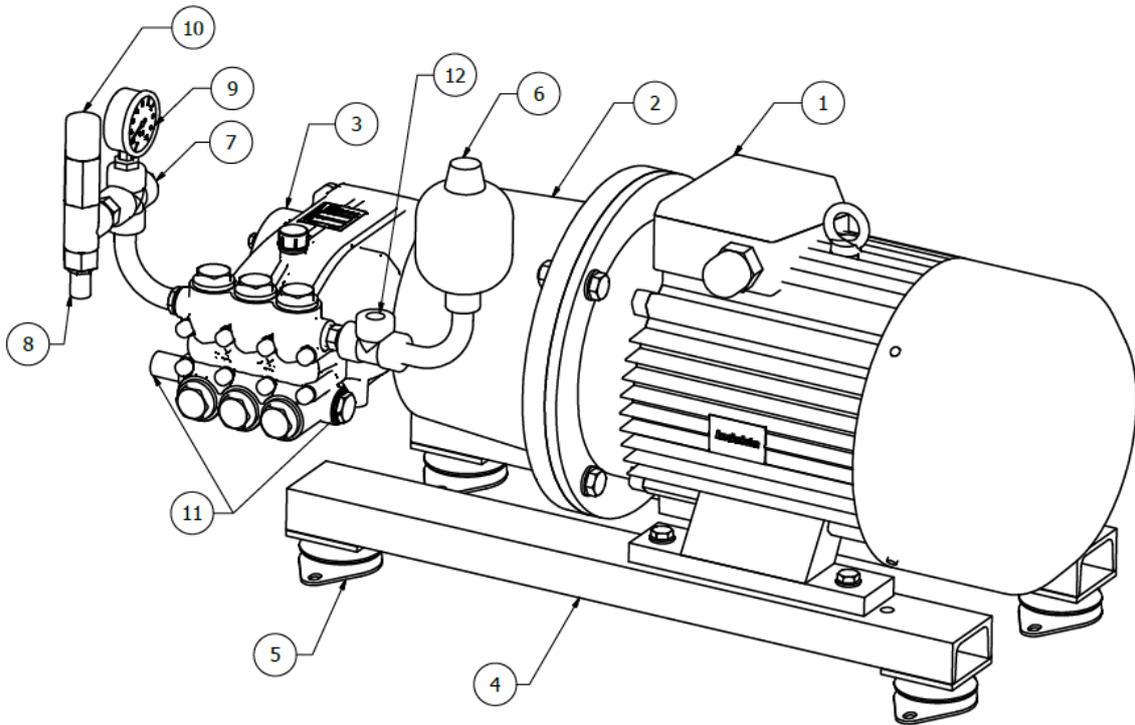


Figure 1 Diagram of an HD pump set

	Name
1	Drive
2	Lantern piece
3	Pump
4	Pump bracket
5	Vibration damper
6	Pulsation damper
7	Pressure sensor connector
8	Return connector
9	Manometer
10	Pressure regulator / overflow
11	Pump suction connector
12	Pump output connector

Table 4 Names of various components

1.2 Use

Van der Ende's HD pumps are designed to pressurize clean water at high pressure into a pipeline system. HD pumps may only be operated if they are installed in a suitable pipeline and water system.

HD pumps may not be used for any purpose other than described above, or when failure of the HD pump could cause potentially dangerous situations.

1.3 Media

Because gaskets and pump parts have limited chemical resistance, an HD pump may not and cannot simply be used with any medium. The standard pump installations are only suitable for water which is clean both chemically and mechanically. Special materials must be used for an HD pump which pumps osmosis water. For more information and advice, contact the sales department at Van der Ende Groep.

If media are used which are not suitable for the selected pump, the guarantee will become invalid.

1.4 Control and operation

A high-pressure pump is driven by an electric motor which can be started manually or controlled remotely. Additional controls and connections, such as a control cabinet or similar, are not covered by these instructions. The operating pressure must be set manually by adjusting the overflow valve. Turning the button on the top of the overflow valve clockwise will increase pressure, turning it anticlockwise will reduce pressure.

1.5 Users

In principle, an HD pump is not controlled directly but by a user/operator with a control panel or other type of external control. Intended users must be at least 18 years old, employed at the company where the HD pump is installed, and designated by the management as competent and authorized to operate the HD pump.

Unintended users are any users who do not meet the above definition. Unintended users are all users who, by using the HD pump, create unsafe situations or danger to themselves or others.

1.6 Operating environment

An HD pump may only be put into operation if it is installed into a suitable system.

When installing the pump, the following points must be respected:

- The inlet pipeline must be one size larger than the inlet size on the suction side of pump;
- Place the pump on a flat surface and below the water level, unless an inlet pressure pump is used;
- Avoid constrictions, bends, T-connectors and other elements which hinder the flow in the inlet pipeline;
- Both the inlet and discharge pipelines must always use flexible fittings to absorb any vibrations which arise (pulsations and pressure shocks);
- Teflon tape or similar must not be used for sealing connections, pipes, fittings, etc., since this tape could end up in the pump. Instead, it is recommended that a liquid sealing material, such as Loctite 542, is used to create airtight seals;
- Use appropriate filters with sufficient capacity in the inlet pipeline, and regularly check these for contamination to ensure sufficient flow is maintained;
- Avoid creating a closed pressurized pipeline system, especially when working with a high-temperature medium, high working pressure and high capacity;
- It is advisable to install a pressure gauge in the inlet pipeline to monitor the inlet pressure;
- Install an overflow relief valve on the discharge side, and set it to a maximum of 10% above the maximum operating pressure.

Warning:

Dirty filters in the inlet/suction pipe can cause very serious damage to the pumps as a result of lack of water. Make sure that filters never become clogged, and regularly check for contamination. Clean if necessary, and install an inlet pressure safety switch after the filter.

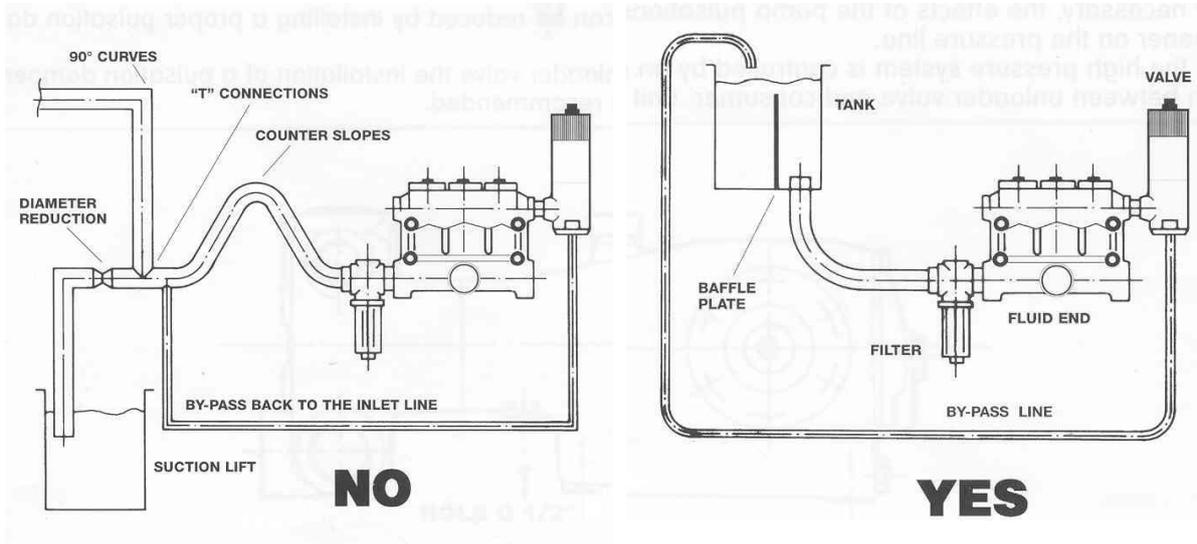


Figure 2 Installation example

The HD standard pump is not intended for use in potentially explosive atmospheres. Check with the manufacturer about options on building the pump set using ATEX components.

1.7 Guarantee provisions

The guarantee is valid for 6 months from the date shown when the machine was put into service, or two years from date of manufacture, whichever is earlier. The date shown when the machine was put into service is the time when the pump was installed in the system.

If a claim is made under guarantee, the parts concerned must be presented to the manufacturer for assessment.

The guarantee shall be invalid in the event of any of the following;

- improper use or installation;
- repeatedly ignoring advice of the manufacturer or supplier;
- repair, maintenance or use by unauthorized persons;
- use of inappropriate power supply or water connections;
- use of the machine in an unsuitable environment;
- intentional damage or modification of the machine.

The warranty conditions are in accordance with METAALUNIE conditions.

1.8 CE mark

The CE mark indicates compliance with the provisions of the Machine Directive, Low Voltage Directive, EMC Directive and PED. Since this concerns an unfinished machine, it is not possible to meet all the provisions and essential safety on delivery of the machine. A list may be requested from the supplier.

The CE mark is located on the sticker on the lantern piece.

In accordance with the Low Voltage Directive, the HD pump is classified as a Class I device.

1.9 Residual risks

It is neither practically nor economically feasible to eliminate 100% of all risks. In addition, risks associated with the machine are closely linked to what the machine does. These residual risks are listed below in a table. It is important that the user is aware of the fact that there are risks associated with the use of this machine. Observe safety precautions to the full to minimize any risk.

Risk page No.	Definition of residual risk	Risk factor ¹	Category
1.	Flexible hoses age due to external influences, and can tear or burst as a result.	3	A
2.	A hazard arises because the pipework is not connected properly by a competent person.	4	A

Table 5 List of residual risks

¹ The aim is to reduce all risks to level A. However, this may not be possible because of what the machine does or practical or economic considerations

2 Description

This chapter description sets out what the machine is precisely. It is background information necessary to use the machine correctly and safely. The letters A, B, C, D, E, F, G or H in brackets refer to a part in Figure 6.

2.1 How it works

An HD pump consists of a drive component and a pump component. The drive component, which is an electric motor, is attached to the pump by a flexible coupling and lantern piece. An HD pump works in accordance with the positive displacement principle. The electric motor drives a crank shaft in the pump section, which in turn drives the plungers up and down. Most triplex plunger pumps have three pistons or plungers. Axial plunger pumps may contain between five and eleven pistons or plungers, depending on their size. The up-and-down movement alternately sucks in fluid then pushes fluid into the discharge pipeline. If the flow per plunger is displayed in a graph, it takes the form of a sine wave. If three plungers are used, then per rotation three sine waves result which overlap each other, making the flow more constant. Fitting a pulsation damper on the discharge side slightly flattens the peaks in flow and pressure, making the machine more consistent and quieter.

2.2 General

The plunger pump is the right tool anywhere where high pressure with relatively little water is required. Plunger pumps belong in the group of “displacement pumps”, and supply a constant amount of water, depending on the plunger diameter and drive speed. The operating pressure is determined by the structure of the various parts of the pump and power of the drive.

Van der Ende Groep HD pumps are available in a number of versions, depending on the desired capacity and operating pressure. Van der Ende manufactures pump sets comprising a suitable plunger pump and a drive. Depending on what is required, the drive is a 2-pole, 4-pole, or 6-pole electric motor. The high pressure plunger pumps are supplied by various manufacturers, namely Danfoss, Pratissoli and Hawk. Each of these manufacturers has a wide range with various types of pumps.

The purpose and function of an HD pump is to maintain a water system at the correct working pressure, and to provide such a system with sufficient capacity. The electric motor is often controlled by a frequency converter.

By setting the electric motor into motion in the right direction, the plungers in the pump are brought into motion. Each rotation causes the plungers to displace a fixed volume, where the total volume of liquid being pumped is directly proportional to the rotational speed. Because three plungers do not generate a constant flow, a pulsation damper is mounted (D) on the pressurized side (F) in order to smooth out peaks. This only applies to Hawk and Pratissoli pumps. A pressure gauge (B) and overflow valve (A) are also fitted as standard. In addition, we recommend installing a pressure switch/sensor (H) on the pressurized side (C). This can measure both excessive and insufficient pressure, in order to protect the pump and the system.

The overflow valve discharges excess liquid away via an overflow pipe. The overflow valve allows the system to be set to a certain pressure. If no water is consumed, all the water is discharged via the overflow valve.

An HD pump is designed to pressurize clean water from a reservoir into a pipeline system. An HD pump may only run if there is sufficient inlet pressure and water input on the suction connection (E) of the pump, so it is strongly recommended that an inlet pressure safety device (G) is installed.

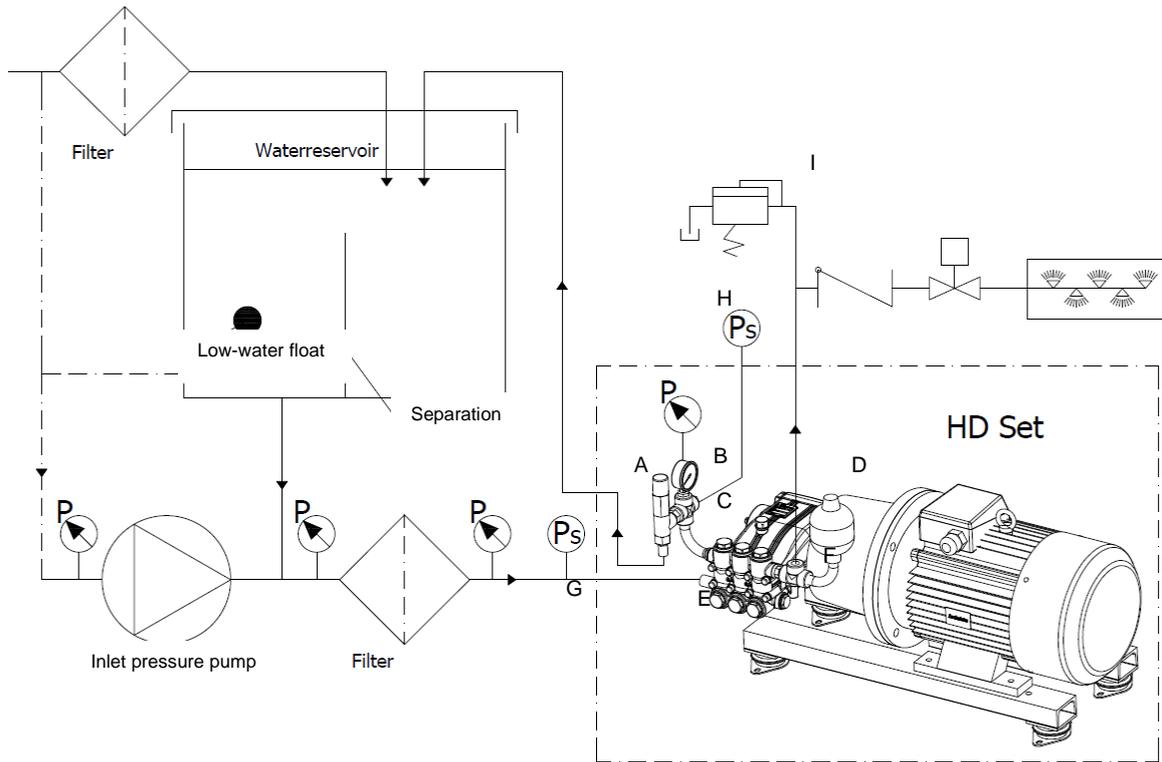


Figure 3 HD pump set flow diagram

2.3 Transport and Storage

There is no special packaging for transport and storage. An HD pump can be placed in a stable position, but cannot and may not be stacked without special provisions for the purpose.

3 Safety instructions

The following safety regulations apply to working with high-pressure pumps:

- You must read this installation manual carefully before installing an HD pump, and respect all the safety instructions.
- HD pumps may only be used for the purpose for which they were designed.
- An HD pump is designed to pressurize clean water from a reservoir into a pipeline system. HD pumps may only be operated if they are installed in a suitable pipeline system.
- During maintenance or repair, the power supply must always be disconnected, and the system relieved of any residual pressure. In order to disconnect the power supply, the isolation switch of the control element (control cabinet or similar) must be switched off and locked into position. After maintenance or repair, always fully reconnect and test everything.
- Only qualified personnel may carry out maintenance or repairs, and connect the electrical part of the pump.
- Always connect the earth wire to the terminal marked with the earth symbol.
- Make sure the power is connected to an earthed end circuit, fitted with a circuit breaker with appropriate rating.
- Always respect all installation and safety regulations. Ignoring these rules may result in severe injury to persons and/or damage to material.
- When turning off the pump, make sure there is no residual pressure in the HD pump, and that it is isolated from the rest of the system.

Safety symbol	Description
	Automatic starting machine!
	Electric voltage present!
	Rotating parts!
	Reading instructions obligated!

4 Installation

Since an HD pump is an unfinished machine, it is not possible for the manufacturer to include all the essential safety devices, such as logic control and emergency stop. It is important, therefore, that the installer takes care of these aspects. In principle, all required safety devices are included in the installation instructions. After installation, the installer must make sure that the whole unit fully conforms with relevant European legislation.

4.1 General

The pipeline system into which the HD is installed must comply with the following requirements:

- Overpressure protection (I) must be installed;
 - The overpressure protection must activate if the pump or pipeline reaches maximum working pressure.
- Flexible hoses must be used for connections;
 - This prevents vibrations from being transported and breaking pipes.
- A motor protection switch must be installed and set to the correct flow;
- An isolation switch must be installed within view of the pump. If this is not possible, it must be possible to lock the isolation switch into position with a padlock or similar;
- All pipelines and fittings must be able to withstand the maximum pressure that the pump can provide;
- All pipelines must be liquid-tight and in good condition;
- The inner diameters of supply, drainage and overflow pipes must be at least as big as that of the connections. Account should be taken of the total pipeline resistance, so that minimum pressure, maximum overpressure and pressure losses of pipelines and the like are not exceeded.

4.2 Assembly

- Place the HD pump set in an appropriate place:
 - make sure the surface is stable;
 - make sure the pump is standing horizontally;
 - make sure that vibrations cannot move the pump from where it stands;
 - make sure there is enough free space around the pump;
 - make sure the pump is protected from the weather.
- Connect the inlet/suction pipeline:
 - use flexible pipes in connections;
 - this prevents vibrations splitting or breaking pipelines.
 - use a large enough filter:
 - maximum degree of filtration 200 microns (for Danfoss, pre-filtration of 10 microns with a β_{10} value > 5000);
 - this prevents small particles and foreign objects from ending up in the pump and inlet pipelines;
 - make sure the inlet/suction pipe cannot become empty, even partially, when the pump is not on;
 - this prevents air entering the inlet/suction pipe;
 - if the pump runs dry, in other words, contains no liquid, it risks suffering irreversible damage.
- Connect the discharge pipeline:
 - use flexible high-pressure pipes at the connection;
 - this prevents vibrations breaking pipelines.
 - install a non-adjustable or lockable overpressure protection device.

- Connect the overflow pipe:
 - do **not** lead the overflow pipe back to the suction pipeline! (This is only permitted under special circumstances, and requires temperature monitoring.)
 - this can negatively affect the operation of the pump if the pump is run without water being consumed from the pressurized side: the water temperature can rapidly rise and exceed the permitted 40°C. This can lead to a considerable reduction in operating lifetime, or irreparable damage.
 - use flexible pipes at the connection;
 - this prevents vibrations breaking pipelines.
 - it is advisable to collect any water discharged by the overpressure protection;
 - this means the activation of the overflow valve can be monitored.

4.3 Electrical

The electric connection of the drive of the HD pump must be carried out by an authorized person. Pay attention to the correct rotation direction of the rotor shaft. Follow these steps:

- Connect the earth:
 - Follow the instructions in the Attachment;
- Connect the power supply:
 - Follow the instructions in the Attachment;
- Connect the electric inlet pressure switch (optional):
 - Follow the instructions in the Attachment;
- Use a motor protection switch with current setting to prevent damage to the electric motor:
 - Unless this current setting is already integrated in a soft starter, inverter or similar;
 - Check whether the current setting is set correctly (see Attachment);
- Use an isolation switch:
 - This allows the machine to be disconnected from the power supply for maintenance or repairs;
- Where necessary, use short-circuit protection;
- If necessary, install an emergency stop button.

If the electric motor is supplied by a frequency inverter, respect the following points:

- Minimum and maximum speed;
- Maximum rated current.

5 Commissioning

5.1 Start up

Before the HD pump is put into service, the following must be checked. If all these points are found to be OK, the HD set can be started. Check:

- The oil level in the pump. The oil level must be at least as high as the middle of the sight glass. If necessary, add oil of the prescribed type;
- The water tank (if applicable) and any suction filters for internal contamination. If necessary, these must be cleaned;
- If the water inlet is open, and/or there is sufficient inlet pressure;
- If any water reservoir present is in accordance with regulations;
- If the valve or valves to the suction filter or filters are open;
- If the inlet/suction pipe and connections have no leaks;
- If the connecting hoses from the discharge port are attached;
- The minimum and maximum permitted drive speed. This must not be exceeded;
- If the overflow valve is adjusted to the lowest or low pressure.

Never let the pump run dry of either water or oil. Air in the pump or pipelines can result in irreparable damage to the pump.

After the above points have been checked, the HD pump can be put into operation. The following steps should be followed in this respect.

- Check the rotation of the drive;
- Depending on use, it is recommended that the pump is allowed to run for a few minutes after starting before being put under pressure, so the oil can heat up;
- Vent the pipeline system;
- Pressurize the system by adjusting the overflow valve (A). Never set the pressure to more than the maximum value. This is specified on the pump sticker on the lantern piece;
- Check if the pressure is correct;
- Check all the connections, hoses and other fittings for any leaks;
- If the high-pressure pump is being used for the first time, it is recommended that pressure is limited to 30 to 50% of the maximum working pressure for the first few hours. After several hours, the pressure can be gradually increased to the maximum pump pressure. In the first few hours, the oil temperature will rise sharply, after which normal operating temperature will be reached. During this period, regularly monitor the temperature and the level of oil in the crankcase;
- If no problems arise during this period, the pump can be used for its intended purpose.

Important:

Accident prevention

The installation must be carried out in such a way to reduce the risk of accidents to a minimum under normal operation. It should be stressed that the "razor-sharp" water jet from the spray gun is dangerous, especially at close range. Never spray in the direction of people, animals or electrical components such as switches, motors, switch cabinets, etc.

5.2 Taking out of service

If the pump is taken out of service for an extended period of time, it is recommended that water is kept in the pump to prevent rust forming on the inside of the pump and the valves sticking. However, if there is a risk of frost, the pump must be drained or it could be broken by ice formation. Alternatively, anti-freeze can be used in the pump.

6 Maintenance

Routine maintenance and inspection is always necessary. Danfoss pumps require maintenance every 8,000 hours. Clean filters and check for oil or water leaks daily. For Hawk and Pratissoli pumps, the following applies.

Every 500 hours	Every 1,000 hours
Check the oil level	Replace the oil
Oil must only be replaced after the first 50 hours.	Check or replace: <ul style="list-style-type: none">• Valves• Valve seats• Valve springs• Valve guides
	Check or replace: <ul style="list-style-type: none">• High Pressure gaskets• Low Pressure gaskets

The set can be cleaned with a dry cloth; never use water on electrical parts. Do not use abrasive cleaners.

Before working on the high-pressure system, make sure it has been depressurized and that the isolating switch is turned off.

6.1 General

Frequency: weekly.

- Turn the isolation switch off;
- Depressurize the pump;
- Check the oil level with the dipstick and/or use the oil sight glass:
 - the oil level should be at the mark;
 - for more on filling/changing oil, see 6.2;
- Check that all connections are secure;
- Check that all hoses are secure;
- Check hoses for wear and damage:
 - replace if necessary;
- Check connecting cables for wear and damage;
- Check if all other nuts and bolts are tight;
- Check the filter in the suction pipeline:
 - remove any foreign objects;
 - remove any dirt and scale deposits;
- Check that the inlet pressure switch is working.

6.2 Oil Change

Frequency: see Table 6.

If oil is changed according to the chart below, the life of the pump can be extended considerably.

Check	Every 500 operating hours
Change	Every 1,000 operating hours or 12 months

Table 6 Oil change schedule

For practical reasons, it is better to change the oil when the pump is hot. The oil is then less viscous and flows more easily out of the sump.

- Turn the isolation switch off;
- Depressurize the pump;
- Place a pan to collect oil under the drain plug;
- Remove the drain plug;
- Recover the old oil and dispose of it as hazardous waste:
 - if there is any water in the oil, directly contact the supplier;
 - if the pump leaks oil, directly contact the supplier;
- Remove any metal particles that have collected on the magnetic drain plug;
- Replace and tighten the drain plug;
- Remove the oil filler plug;
- Fill the pump with oil:
 - Only use **"Shell Omala S2 GX 220"** oil or which is attributed in the product specifications of the high pressure pump.

Check the oil level carefully when filling; too much oil is just as harmful as too little.

For pumps fitted with grease nipples on the piston seals:

- Lubricate every 50 to 100 hours with HPF12 grease;
- Use about 2 cm³ of grease per nipple each time.

7 Failures

Before attempting to resolve any problem, always disconnect the pump from the power supply and depressurize it.

Problem	Cause	Solution
Electric motor does not work	Faulty circuit breaker	Check/replace all breakers
	Thermal protection activated	Reset thermal protection
	Cord/plug defective	Check/replace power cord and plug
Pump fails to reach pressure	Not properly vented	Open relief valve to let air out, then close
	Relief valve is open (if used)	Shut relief valve
	Inlet pressure too low	Water reservoir level too low or empty. Check low-water float. Make sure the inlet pressure pump is on. Check the filter for contamination. Check the inlet pressure protection.
	No fluid flow	Control inlet/suction pipe, inlet pressure pump or reservoir
	Collars defect	Contact supplier
	Overflow valve defect	Contact supplier
Pressure fluctuates	Contaminated suction filter	Clean filter
	Porous inlet hose	Replace hose
	Overflow valve defect	Contact supplier
	Hoses/couplings incorrectly installed	Check hoses/couplings
Pump "bumpy"	Dirty and/or faulty valves	Contact supplier
	Pump drawing in air	Check suction connection for cracks and/or holes
Pump leaks water	Loose coupling or bolts	Check couplings and bolts Otherwise, contact supplier
	Loose hose or hose clamps	Check hoses and hose clamps, tighten or replace as necessary
	Collars leak	Contact supplier
Pump leaks oil	Defective seals	Contact supplier

Table 7 Troubleshooting

8 Declaration of conformity

EC DECLARATION OF CONFORMITY

(According to Annex II B of the Machinery Directive 2006/42/EC for non-stand-alone machines or machine parts)

We, Van der Ende Pompen BV
Aartsdijkweg 23
2676 LE Maasdijk
The Netherlands

declare, under sole responsibility, that the following machines

HD Pumps
Danfoss, Pratissoli and Hawk series

to which this declaration refers are intended to be incorporated into machinery or assembled with other machines into one single machine to which the Machinery Directive applies (if applicable), in accordance with the following harmonized standards and/or guidelines;

Machinery Directive 2006/42/EC
Low Voltage Directive 2006/95/EC
EMC Directive 2004/108/EC
PED 97/23/EC

We hereby alert you to the fact that our product is intended to be incorporated into a machine or be assembled with another machine, and that, according to the Machinery Directive, it may only be put into service after the completed composite machine is in accordance with the provisions of the European requirements.

The Netherlands
Maasdijk
14 January 2020

L. van der Ende



Attachments

- **Direct electrical connection to the electric motor**
- **Electrical connection to the pressure switch**

Direct electrical connection to the electric motor

If a star/delta switch is not used, the electric motor must be connected as shown below. See the electric motor's nameplate for more information.

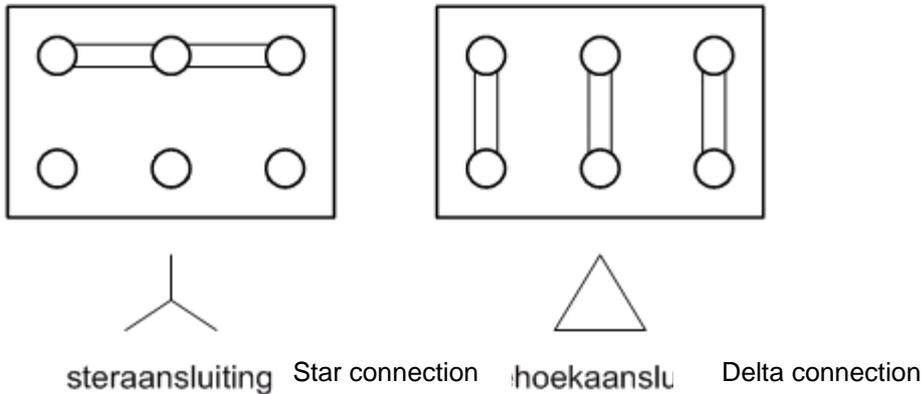


Figure 4 Star or delta connection

Electrical connection of pressure switch on the discharge side (OPTIONAL)

The pressure switch is supplied with approximately one metre of 3-core cord. An example of a pressure switch is illustrated in figure 6. When the measured pressure is below the desired pressure, the red and brown cores make contact. Once the pressure exceeds the switching pressure of the pressure switch, the brown and blue cores are connected by the pressure switch. Several different pressure switches are available. Figure 7 shows an example of a pressure switch for the low-pressure side.

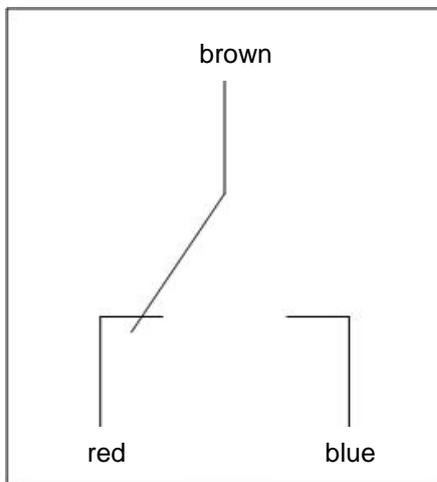


Figure 5 Pressure switch circuit diagram, no pressure situation



Figure 6 Pressure switch, high pressure



Figure 7 Pressure switch, low pressure

It is recommended installing this in a failsafe way so that there is a constant connection when there are no problems. If a wire breaks, an alarm is given.







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